

Description of the larva of *Argia percellulata* (Odonata: Coenagrionidae)

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The larva of *Argia percellulata* is described and figured. It falls into the group of *Argia* larvae with a very prominent ligula and one palpal seta, but differs from its closest relatives by having tibiae usually with two well-defined dark rings, posterior margin of sternite 6 smooth, and posterior margin of sternite 7 smooth medially and with spiniform setae laterally. Larvae were found under cobblestones in open, wide, shallow streams where the water flow was slow to moderate, close to the shoreline within a cloud forest. The larva is compared with four other species apparently closely related.

Keywords: Odonata; Zygoptera; damselfly; *Argia percellulata*; larval description; Mexico

Introduction

Argia percellulata Calvert is an endemic Mexican species with a restricted distribution thus far known only from the states of Chiapas, Puebla, Oaxaca and Veracruz (González-Soriano & Novelo-Gutiérrez, 2007; Garrison, unpublished data), ranging from 380 m at Río Tecpatlán, Zihuateutla, Puebla (Cuevas-Yáñez, 2007), to 1980 m at the vicinity of Sierra de Juárez, Oaxaca (Garrison, pers. com.). The original vegetation at all localities was cloud forest, although in Coatepec the forest has been largely replaced by coffee plantations and pasture land. Larvae were not reared to emergence, but we are confident of their identity because the only other large species of *Argia* found in Coatepec over 20 years of intensive collections is *A. lacrimans* (Hagen), the larva of which is quite different in several features (Novelo-Gutiérrez, 1992). Moreover, in four mature larvae the wing venation is quite visible by transparency, revealing six and five postquadrangular cells on forewings and hind wings, respectively, as described by Calvert (1902) for adults of *A. percellulata*. Finally, two larvae from Coatepec were captured in the same spot where a small breeding population of *A. percellulata* occurs every year.

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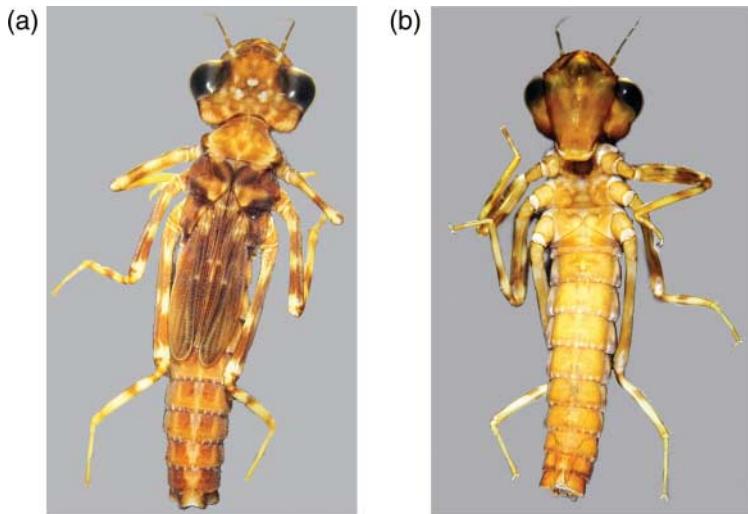


Figure 1. Dorsal (a) and ventral (b) views of F0 male larva of *Argia percellulata* (gills detached).

Methods

Larvae were collected with a D-frame aquatic net and preserved in the field in 96% ethanol. Afterwards, they were transferred to vials containing 80% ethanol. Mandibular nomenclature follows Watson (1956). Drawings were made with aid of a camera lucida on a stereomicroscope ZEISS Stemi SV 6. Photographs were obtained with a CANON PowerShot G10 digital camera mounted in a stereomicroscope ZEISS Stemi 2000-C. Measurements (in mm) were made with a calibrated ocular micrometer as follows: Head width, across compound eyes; total length, dorsally from anteriormost margin of labrum to posteriormost margin of abdominal segment 10; abdomen length, ventrally to posteriormost margin of abdominal segment 10; hind femora, along midline of external surface. S1–S10 = abdominal segments 1 to 10. F0 = last instar larva.

Larva of *Argia percellulata* (Figures 1–12)

Specimens examined

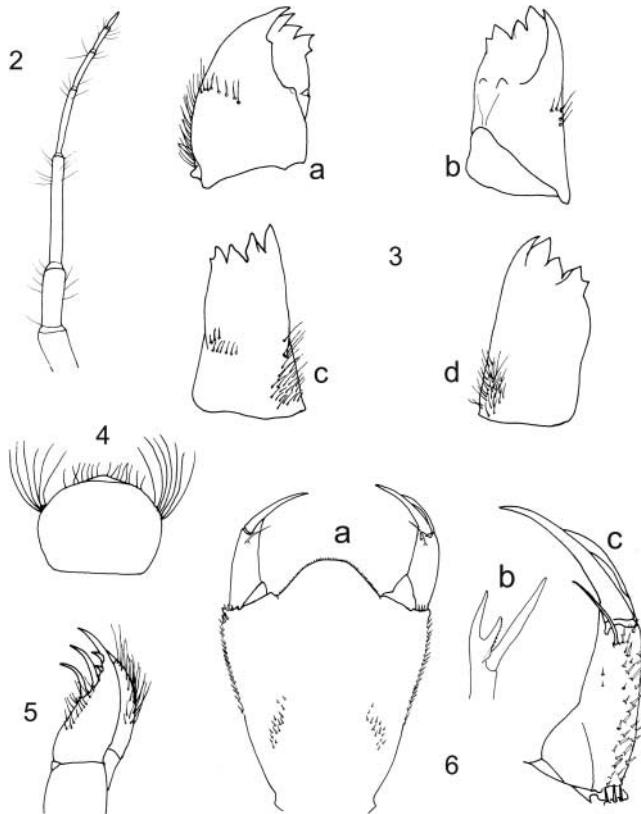
Seven F0 larvae (four males, three females): Mexico: Veracruz, Coatepec, Río Huehueyapan, La Marina ($19^{\circ} 27' 09''$ N, $96^{\circ} 58' 53''$ W; 1196 m), 19 April 2000, R. Arce leg (one male); same data but 1 May 2002, R. Novelo leg (one female); Puebla, Tecpatlán ($20^{\circ} 14' 28''$ N, $97^{\circ} 51' 35''$ W; 380 m), 3 May 2002, K. Cuevas leg (three males, two females). All specimens deposited at Colección Entomológica del Instituto de Ecología, A.C. (IEXA).

Diagnosis

A moderately robust larva (Figure 1a), ground color brown with light areas, legs with wide dark bands separated by narrow pale areas. Caudal lamellae mostly gray or grayish-violet in basal half, remainder pale with an indefinite, transverse gray band.

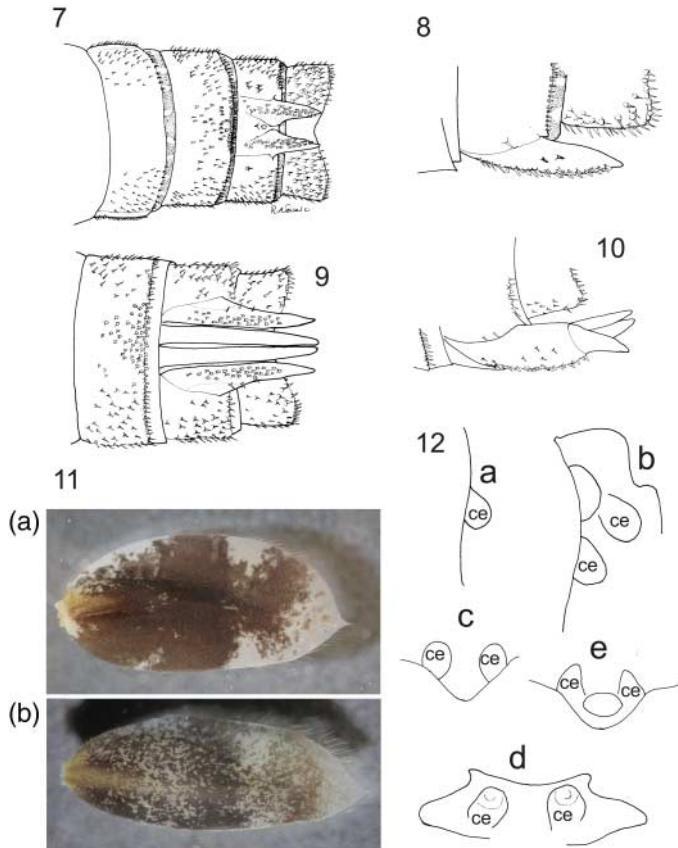
Description

Head. Wider than long, posterior margin widely concave, dorsal color pattern as in Figure 1a. Cephalic lobes rounded with posterolateral margins bearing stout spiniform setae. Labrum brown,



Figures 2–6. Details of larval morphology of *A. percellulata*. (2) Left antenna, dorsal view. (3) Mandibles: (a) right and (b) left mandibles, ventrointernal view; (c) right and (d) left mandibles, external view. (4) Hypopharynx, ventral view. (5) Ventral view of left galeolacinia. (6) Labium: (a) prementum, dorsal view; (b) end hooks and movable hook of left palp, frontal view; (c) right palp, dorsal view.

setose, setae whitish; clypeus trapezoidal, brown, with a pair of parallel, narrow white lines along middle third. Antennae seven-segmented (Figure 2), scarcely longer than head, scape short and pale, remainder of antennomeres brown; proportional length of antennomeres (from basal to apical): 0.4, 0.55, 1.0, 0.6, 0.45, 0.25, 0.15. Mandibles (Figure 3) with molar teeth but lacking molar crest, with following formula: L 1'1 2 3 4 0 a b / R 1'1 2 3 4 y a 0, both mandibles with a ventral transverse, row of setae running from external margin of mandible to level of internal border of tooth 4. Ventral pad of hypopharynx subquadangular with a tuft of 6–7 long, robust setae located subapically to each anterolateral corner, and a transverse row of smaller setae on anterior margin (Figure 4). Maxilla: galeolacinia (Figure 5) with six teeth, three dorsal teeth approximately of the same size, three ventral teeth of differing sizes, apical one the longest, a row of stiff setae preceding both ventral and dorsal teeth. Labium yellowish brown. Prementum-postmentum articulation reaching posterior border of procoxae. Prementum 0.80 times as wide as long (Figure 6a), with a row of 17–20 spiniform setae along distal half of lateral margins and a group of 15–21 basidorsal spiniform setae of differing size; ligula very prominent (2.95 times wider at its base than long, measured dorsally), with closely set, minute claviform setae on distal margin. Premental palp with two end hooks shorter than movable hook, the ventral (medial) one longest (Figure 6b), internal margin of palp finely serrate, external margin of smaller end hook with a row of minute, sharp denticles; palp with one long setae basal to movable hook, and an irregular row of 24–26 short, stout spiniform setae along dorsal margin (Figure 6c); a row of three, stout spiniform setae at base of palp articulation.



Figures 7–12. Details of larval morphology of *A. percellulata*. (7) Sternites 7–10 showing setae and male gonapophyses. (8) Male gonapophyses, left lateral view; (9) Sternites 8–10 showing setae and female gonapophyses. (10) Female gonapophyses, left lateral view. (11) Caudal lamellae: (a) median lamella, left lateral view; (b) lateral lamella, external view. (12) (a–d) Male cerci: (a) lateral, (b) dorsolateral, (c) dorsal, (d) ventral; (e) female cerci, dorsal view. Ce = cercus.

Thorax. Pronotal disk mostly light brown with some scattered, long setae and spiniform setae on anterodorsal surfaces, lateral margins dark brown, strongly convex, and covered with long setae; propleura dark brown. Synthorax mostly brown with a wide, pale band on anterior half of mesepimera (Figure 1a). Wing sheaths brown, anterior pair scarcely surpassing posterior margin of S4, posterior pair reaching basal half of S5. Legs short (i.e., tip of metatibiae scarcely surpassing S10 when fully extended), pro- and mesotibiae longer than respective femora; metafemora and metatibiae subequal. Femora with two large, wide, dark bands connected to each other by a thin line at middle, an incomplete basal dark ring widely connected with subbasal large dark band, the pale intervening spaces reduced (Figure 1a); tibiae with two dark, well-defined rings at basal and middle areas (sometimes with a third, well-defined, subapical dark ring), narrower than intervening pale spaces; dorsal and ventral borders of femora, external surface of profemora, and internal and external borders of tibiae with robust spiniform setae, these spiniform setae intermingled with long, stiff setae on dorsal borders of femora and external borders of tibiae; apicointernal border of tibiae with some large, robust, reddish, spine-like setae intermingled with abundant long setae and tridentate setae; tarsi with abundant, yellow, stiff setae on ventral surface, and long, delicate, whitish setae on dorsum.

Abdomen. Wider at base, reaching maximum width at S3, and then gradually narrowing caudally. Tergites with complex color pattern, but mostly dark with a pale spot along midline, triangular

on tergites 5–9, subquadrangular on tergite 10, and submedian, longitudinal stripe to each side of midline on tergites 2–9; tergite 1 pale (Figure 1a). Lateral margins of S1–6 with dark blotch on apical half (Figure 1b); lateral margins of S1–5 slightly convex, straight on S6–10; tergites 1–4 smooth, 5–10 with spiniform setae, scattered on 5 and increasingly abundant caudally; a tuft of long white setae along midline on tergites 2–10. Sternites 1–6 and middle third of 7 smooth, lateral thirds of sternites 7–10 with spiniform setae, middle third of sternites 8–10 with claviform setae except on smooth, small central area of sternite 10 (Figure 7). Male gonapophyses (Figures 7, 8) long, parallel, spatulate and with tips pointed but not acute, reaching posterior margin of sternite 10 (Figure 7); ventral border with 29–31 stout, dark, claviform setae (Figure 8). Female gonapophyses (Figures 9, 10) exceeding posterior margin of S10 by 0.50 length of S10; lateral valves, in ventral view (Figure 9), with tips pointed, ventral border with 29–30 stout, claviform setae on basal 0.75; in lateral view (Figure 10) with 2–3 spiniform setae on external surface; median valves smooth. Caudal lamellae (Figure 11) with moderately acuminate tips. Lateral lamella (paraproct) (Figure 11b) strongly inflated on basal 0.55 on external side, apical 0.45 laminar, 2.5 times longer than its widest part; a laterobasal, triangular, amber-colored, chitinous plate at basal 0.25 of length of lamella bearing stout, long, spiniform setae; dorsal and ventral borders smooth, fringed with delicate white setae on apical 0.40 and 0.50 respectively; most of lamella gray or grayish violet on basal 0.55, apical 0.45 white with a wide, transverse, gray band (Figure 11b). Central lamella (epiproct) (Figure 11a) inflated at basal 0.40 on both sides, almost two times longer than its widest part; lateral, triangular, amber-colored, chitinous plate extending to basal 0.25 of length of lamella and bearing stout spiniform setae intermingled with stiff setae; dorsal and ventral borders as described for lateral lamella and color pattern as in Figure 11a. Male cerci short (Figure 12a–d), globose in dorsal and ventral views (Figure 12c, d), roundly pointed. Female cerci triangular in dorsal view (Figure 12e).

Measurements (mm). Total length (without caudal lamellae) 15.5–16.3 ($n = 6$); maximum width of head 4.5–4.6 ($n = 6$); hind femur 4.5–4.7 ($n = 12$); abdomen 9.0–10.1 ($n = 6$); paraprocts 5.8–6.5 ($n = 4$); epiproct 4.2–4.8 ($n = 3$).

Remarks

Larvae of *Argia percellulata* were found under cobblestones close to shoreline in exposed, wide (e.g. 15 m), and shallow streams where the water flow was slow to moderate, within a cloud forest.

Discussion

Argia percellulata falls into the group of *Argia* larvae with very prominent ligula and one palpal seta (Novelo-Gutiérrez, 1992) and shows a great resemblance to *A. barretti* Calvert (Novelo-Gutiérrez, 2008), *A. harknessi* Calvert (Novelo-Gutiérrez, 1992), *A. insipida* Hagen *in* Selys (Geijskes, 1943), and *A. joergensi* Ris (von Ellenrieder, 2007), all sharing the following features: antennal scape pale (except in *A. insipida*; cf. Geijskes, 1943, plate 3, figure b); ligula strongly prominent; premental palp with one seta; femora with dark bands wider than intervening pale spaces; sternite 8 with abundant claviform setae on the middle; male gonapophyses spatulate, bluntly pointed, beset with claviform setae on ventral border; female gonapophyses bluntly pointed, lateral valvae with abundant claviform setae on ventral border; male cerci globose; caudal lamellae inflated basally, with a short acuminate tip, ventral and dorsal borders free of stout setae. Of all these species, *A. percellulata* has the greatest number of basidorsal spiniform setae on the prementum (15–21) and is the largest in stature.

The larva of *A. percellulata* differs from the above-mentioned species [in square brackets] as follows: (1) tibiae usually with two dark rings well-defined [one ring, *joergensi*; three rings, *barretti*, *harknessi*, *insipida*]; (2) posterior margin of sternite 6 smooth [smooth medially, with spiniform setae at sides in *barretti* and *joergensi*; unknown for *insipida*]; (3) posterior margin of sternite 7 smooth medially, with spiniform setae at sides [mostly smooth with scattered spiniform setae at sides, *harknessi*; with claviform setae on middle and spiniform setae at sides, *barretti*; unknown for *insipida*] (in this feature, similar to *joergensi*); (4) male gonapophyses, in ventral view, with external margin straight in basal half [this margin strongly sigmoid in *barretti*, *harknessi*, *joergensi* and *insipida*].

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